Anesthesia for the Jehovah’s Witness

Brianne Zander RN, BSN, SRNA
York College of Pennsylvania
Objectives

• Discuss the history and religious doctrines that relate to managing Jehovah’s Witnesses perioperatively
• Describe various blood products and their acceptance by Jehovah’s Witnesses
• Explain several options for pre-optimization for surgery
• Discuss anesthetic interventions for hemodynamic control intraoperatively
Basic Jehovah’s Witness History

- Founder: Charles Taze Russell in 1881
- Jehovah’s Witness beliefs
- Medically relevant doctrines
- Changes in religious doctrine
- Current governing body
Beliefs About Blood

- Origination of beliefs
- Four categories
  - Red cells
  - White cells
  - Platelets
  - Plasma
- Changes in transfusion medicine
### Blood Products

<table>
<thead>
<tr>
<th>Acceptability</th>
<th>Blood products and related procedures in Jehovah's Witnesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unacceptable</td>
<td>Whole blood, Packed red cells, Plasma, Autologous predonation, Cardiopulmonary bypass, Renal dialysis, Acute hypervolaemic haemodilution, Recombinant erythropoietin, Recombinant factor VIIa, Platelets, Clotting factors, Albumin, Immunoglobulins, Epidural blood patch, Cell saver</td>
</tr>
<tr>
<td>Acceptable</td>
<td>A matter of personal choice</td>
</tr>
<tr>
<td>May be acceptable (‘matters of conscience’)</td>
<td>Whole blood, Red cells, White cells, Platelets, Plasma, Autologous blood which has been donated preoperatively and stored</td>
</tr>
</tbody>
</table>

Blood products and whether they may or may not be acceptable to Jehovah’s Witnesses:

- Whole blood
- Red cells
- White cells
- Platelets
- Plasma
- Autologous blood which has been donated preoperatively and stored
- Albumin
- Immunoglobulins
- Clotting factors
- Intraoperative cell salvage
- Cardiopulmonary bypass
- Haemofiltration or haemodialysis (although in chronic renal failure peritoneal dialysis should be first choice)
- Epidural blood patch — using a closed system
- Bone marrow and solid organ transplants
<table>
<thead>
<tr>
<th>Elective framework</th>
<th>Emergency framework</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organize confidential meeting (free from coercion; medical, religious, or familial)</td>
<td>Depends on:</td>
</tr>
<tr>
<td>Explain that your opinions are based on current best evidence and practice and your aim is not to be coercive, only informative</td>
<td>• Presence of capacity</td>
</tr>
<tr>
<td>Discuss the need to optimize haemoglobin before surgery and potential for postponement</td>
<td>• Patient age</td>
</tr>
<tr>
<td>Establish Jehovah’s Witness status, beliefs, and advance directive</td>
<td>• Presence of an advance directive</td>
</tr>
<tr>
<td>Establish opinion on blood products, highlighting local availability, experience or inexperience with alternative or novel therapies, etc.</td>
<td>Aim for a private discussion with patient or next of kin, free from coercion (medical, religious, or familial)</td>
</tr>
<tr>
<td>Determine what products or procedures are acceptable or unacceptable</td>
<td>Establish urgency and time-sensitive nature of scenario</td>
</tr>
<tr>
<td>Explain proposed medical intervention, including pros, cons, risks (including death, disability, and suffering) and alternatives (including no intervention)</td>
<td>Establish Jehovah’s Witness status and position on blood and blood products</td>
</tr>
<tr>
<td>Form worst case scenario plan</td>
<td>Use collateral sources if necessary, including advanced directives and hospital Jehovah’s Witness liaison</td>
</tr>
<tr>
<td>Fully document discussion and acceptable options</td>
<td>Explain clearly the patient’s condition, prognosis, and treatment options, including your recommendation</td>
</tr>
<tr>
<td></td>
<td>Aim for consensus and compromise</td>
</tr>
<tr>
<td></td>
<td>If consensus and compromise are impossible, consider the patient’s best interests with regard to the law</td>
</tr>
<tr>
<td></td>
<td>Fully document discussion, actions, etc.</td>
</tr>
</tbody>
</table>
Goals for the Jehovah’s Witness Patient

• Minimize blood loss
• Tolerate lower hemoglobin/hematocrits
• Diagnose and treat preoperative anemia
• Salvage intraoperative blood when possible
• Optimize surgical hemostasis
Optimization for Surgery
<table>
<thead>
<tr>
<th>Preoperative</th>
<th>Minimise blood loss</th>
<th>Manage anaemia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify, assess, and treat anaemia</td>
<td>Identify and manage bleeding risk (past and family history)</td>
<td>Compare estimated blood loss with patient-specific tolerable blood loss</td>
</tr>
<tr>
<td>Consider preoperative autologous blood donation</td>
<td>Review medications (antiplatelet, anticoagulation treatment)</td>
<td>Assess and optimise patient’s physiological reserve (eg, pulmonary and cardiac function)</td>
</tr>
<tr>
<td>Consider erythropoiesis-stimulating agents if nutritional anaemia is ruled out or treated</td>
<td>Minimise iatrogenic blood loss</td>
<td>Formulate patient-specific management plan with appropriate blood conservation modalities to manage anaemia</td>
</tr>
<tr>
<td>Refer for further assessment if necessary</td>
<td>Procedure planning and rehearsal</td>
<td></td>
</tr>
<tr>
<td>Unmanaged anaemia (haemoglobin in women &lt;120 g/L, haemoglobin in men &lt;130 g/L) is a contraindication for elective surgery</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intraoperative</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Time surgery with optimisation of red blood cell mass</td>
<td>Meticulous haemostasis and surgical techniques</td>
<td>Optimise cardiac output</td>
</tr>
<tr>
<td></td>
<td>Blood-sparing surgical techniques</td>
<td>Optimise ventilation and oxygenation</td>
</tr>
<tr>
<td></td>
<td>Anaesthetic blood-conservation strategies</td>
<td>Evidence-based transfusion strategies</td>
</tr>
<tr>
<td></td>
<td>Acute normovolaemic haemodilution</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cell salvage and reinfusion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pharmacological and haemostatic agents</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Avoid coagulopathy</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Postoperative</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Manage nutritional or correctable anaemia (eg, avoid folate deficiency, iron-restricted erythropoiesis)</td>
<td>Monitor and manage bleeding</td>
<td>Maximise oxygen delivery</td>
</tr>
<tr>
<td>Treatment with erythropoiesis-stimulating agents if appropriate</td>
<td>Maintain normothermia (unless hypothermia indicated)</td>
<td>Minimise oxygen consumption</td>
</tr>
<tr>
<td>Be aware of drug interactions that can cause anaemia (eg, ACE inhibitor)</td>
<td>Autologous blood salvage</td>
<td>Avoid and treat infections promptly</td>
</tr>
<tr>
<td></td>
<td>Minimise iatrogenic blood loss</td>
<td>Evidence-based transfusion strategies</td>
</tr>
<tr>
<td></td>
<td>Management of haemostasis and anticoagulation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Awareness of adverse effects of medications (eg, acquired vitamin K deficiency)</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1: Patient blood management

These recommendations apply in the perisurgical period enable treating physicians to have the time and methods to provide patient-centred and evidence-based patient blood management to minimise allogeneic blood transfusions. Modified from Goodnough and Shander,14 by permission of the American Society of Anesthesiologists.
<table>
<thead>
<tr>
<th>Clotting Factor</th>
<th>Synonyms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fibrinogen</td>
<td>Factor I</td>
</tr>
<tr>
<td>Prothrombin</td>
<td>Factor II</td>
</tr>
<tr>
<td>Tissue factor</td>
<td>Factor III; tissue thromboplastin</td>
</tr>
<tr>
<td>Calcium</td>
<td>Factor IV</td>
</tr>
<tr>
<td>Factor V</td>
<td>Proaccelerin; labile factor; Ac-globulin (Ac-G)</td>
</tr>
<tr>
<td>Factor VII</td>
<td>Serum prothrombin conversion accelerator (SPCA); proconvertin; stable factor</td>
</tr>
<tr>
<td>Factor VIII</td>
<td>Antihemophilic factor (AHF); antihemophilic globulin (AHG); antihemophilic factor A</td>
</tr>
<tr>
<td>Factor IX</td>
<td>Plasma thromboplastin component (PTC); Christmas factor; antihemophilic factor B</td>
</tr>
<tr>
<td>Factor X</td>
<td>Stuart factor; Stuart-Prower factor</td>
</tr>
<tr>
<td>Factor XI</td>
<td>Plasma thromboplastin antecedent (PTA); antihemophilic factor C</td>
</tr>
<tr>
<td>Factor XII</td>
<td>Hageman factor</td>
</tr>
<tr>
<td>Factor XIII</td>
<td>Fibrin-stabilizing factor</td>
</tr>
<tr>
<td>Prekallikrein</td>
<td>Fletcher factor</td>
</tr>
<tr>
<td>High-molecular-weight kininogen</td>
<td>Fitzgerald factor; HMWK (high-molecular-weight kininogen)</td>
</tr>
<tr>
<td>Platelets</td>
<td></td>
</tr>
</tbody>
</table>

**Anatomy and Physiology**

1. Severed vessel
2. Platelets agglutinate
3. Fibrin appears
4. Fibrin clot forms
5. Clot retraction occurs
Extrinsic Pathway

Intrinsic Pathway

Common Pathway

Anatomy and Physiology
- Vitamin K
  - Clotting factors II, VII, IX, and X
  - Proteins C, S, and Z
- Factor 9 complex
  - Clotting factors II, VII, IX, and X
  - Given with vitamin K
  - 20 IU/kg over 15 minutes
- Cryoprecipitate
  - 1-2 U/10 kg body weight or 2 pools

Discontinue or Reverse Anticoagulation
Iron

- CBC to evaluate for anemia
- Supplementation
  - Elderly, menstruating females, impaired intestinal absorption, inadequate dietary intake
  - IV versus PO
- Effect of inflammatory state
- Plan optimization ahead of time
  - Preoperative assessment!

**Figure 33-5** shows the basic chemical steps in the formation of hemoglobin. First, succinyl-CoA, which is formed in the Krebs metabolic cycle (as explained in Chapter 68), binds with glycine to form a pyrrole molecule. In turn, four pyrroles combine to form protoporphyrin IX, which then combines with iron to form the *heme* molecule. Finally, each heme molecule combines with a long polypeptide chain, a *globin* synthesized by ribosomes, forming a subunit of hemoglobin called a *hemoglobin chain* (**Figure 33-6**). Each chain has a molecular weight of about 16,000; four of these chains in turn bind together loosely to form the whole hemoglobin molecule.
Erythropoietin (EPO)

- Erythropoiesis-stimulating drug
- Works with ferritin, transferrin, iron, vitamin B12, and folic acid
- Response to erythropoietin is dose dependent
- Effects are typically seen within 10 days
  - Significant erythropoiesis seen in 1–6 weeks
CONCLUSION: The administration of erythropoietin before cardiac surgery is associated with a significant reduction in the risk of exposure to allogeneic blood transfusion. Further studies are required to definitively establish the safety of erythropoietin alone.
Intraoperative Interventions
Tranexamic Acid (TXA)

- Inhibition of plasminogen
- Impairs fibrinolysis
- More potent than aminocaproic acid
- Distributes through all body tissues
• Goal: reduce bleeding and transfusion requirements

• Use in bleeding trauma patients
  • 1 g loading dose and 1 g infusion
  • Reduced mortality from hemorrhage

Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant haemorrhage (CRASH-2): a randomised, placebo-controlled trial

CRASH-2 trial collaborators*

Summary
Background Tranexamic acid can reduce bleeding in patients undergoing elective surgery. We assessed the effects of early administration of a short course of tranexamic acid on death, vascular occlusive events, and the receipt of blood transfusion in trauma patients.

Methods This randomised controlled trial was undertaken in 274 hospitals in 40 countries. 20 211 adult trauma patients with, or at risk of, significant bleeding were randomly assigned within 8 h of injury to either tranexamic acid (loading dose 1 g over 10 min then infusion of 1 g over 8 h) or matching placebo. Randomisation was balanced by centre, with an allocation sequence based on a block size of eight, generated with a computer random number generator. Both participants and study staff (site investigators and trial coordinating centre staff) were masked to treatment allocation. The primary outcome was death in hospital within 4 weeks of injury, and was described with the following categories: bleeding, vascular occlusion (myocardial infarction, stroke and pulmonary embolism), multiorgan failure, head injury, and other. All analyses were by intention to treat. This study is registered as ISRCTN86750102, Clinicaltrials.gov NCT00375258, and South African Clinical Trial Register DOH-27-0607-1919.

Findings 10 096 patients were allocated to tranexamic acid and 10 115 to placebo, of whom 10 060 and 10 067, respectively, were analysed. All-cause mortality was significantly reduced with tranexamic acid (1463 [14·5%] tranexamic acid group vs 1613 [16·0%] placebo group; relative risk 0·91, 95% CI 0·85–0·97; p=0·0035). The risk of death due to bleeding was

Interpretation Tranexamic acid safely reduced the risk of death in bleeding trauma patients in this study. On the basis of these results, tranexamic acid should be considered for use in bleeding trauma patients.
• Not recommended if the patient takes:
  • Birth control, post-menopausal hormone replacement therapy
  • Factor IX concentrates
  • Alteplase, streptokinase, urokinase

• Contraindications:
  • Hypersensitivity reaction
  • Leukemia
  • Thromboembolic disease, DIC
  • Intracranial bleeding
  • Renal failure
Aminocaproic Acid

• Synthetic antifibrinolytic
  • Binds to plasminogen/plasmin molecule
  • Inhibits the ability of plasmin to lyse fibrin clots
• Dose: 4-5 g IV over 1 hour → IV infusion 1 g/hour over 8 hours
• Give slowly
• Precautions with other prothrombotic agents
Desmopressin (DDAVP)

- Vasopressin analog
- Treats hemophilia, von Willebrand’s disease, and bleeding
- Effects on bleeding:
  - Increases plasma concentrations of factors VII and VIII
  - Increases concentrations of von Willebrand factor
  - Increases tissue plasminogen activator
  - Improves platelet adhesiveness
- Dose: 0.2 to 0.4 mcg/kg/dose IV or SQ
- Hypotension
Acute Normovolemic Hemodilution (ANH)

• Process
  • Removal of blood
  • Administration of fluid
  • Reinfusion of blood after surgical blood loss
  • CLOSED CIRCUIT
• Temporarily induced anemia
  • Risk of ischemia
• Factors affecting success of ANH
Hypervolemic Hemodilution

- Process
  - Blood is not removed
  - Administration of fluid
  - Blood loss has a reduced hematocrit
- Want vasodilation
  - Nitroglycerin, remifentanil
- No need for a closed circuit

The effect of acute normovolemic hemodilution and acute hypervolemic hemodilution on coagulation and allogeneic transfusion.

Saricaoglu E, Akinci SB, Celiker V, Aypar U.

Abstract

OBJECTIVE: In this study, acute normovolemic hemodilution (ANH) and hypervolemic hemodilution (HHD) were compared with no hemodilution with regards to the effectiveness in blood usage and coagulation parameters.

METHODS: The study was performed from February to August 2001 at Hacettepe University Hospital, Ankara, Turkey. Thirty patients undergoing hip arthroplasty surgery were prospectively randomized into: ANH group [autologous blood 15 mL kg(-1) was withdrawn and replaced by 6% hydroxyethylstarch (HES)] or HHD group (HES was administered without removal of any autologous blood) or the control group (no hemodilution). In all groups, blood was given when hemoglobin concentration was <9 g dl(-1).

RESULTS: Three groups were clinically similar regarding blood loss, mean arterial pressures and coagulation parameters. But allogeneic transfusion requirements were significantly less in hemodilution groups (20% in ANH, 40% in HHD) compared to the control group (100% of patients).

CONCLUSION: We conclude that hemodilution (both ANH and HHD) decreases the demand for homologous blood without adversely affecting hemodynamics or coagulation parameters and HHD seems to be a simple and valuable alternative to ANH in orthopedic patient undergoing hip replacement.
Volume Replacement

- Lactated Ringers
- Hydroxyethyl starches
- Saline
- Dextran
- Albumin

<table>
<thead>
<tr>
<th>Fluid</th>
<th>Na⁺ (mEq/L)</th>
<th>K⁺ (mEq/L)</th>
<th>Glucose (g/L)</th>
<th>Osm</th>
<th>pH</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>5% Albumin</td>
<td>145 ± 15</td>
<td>&lt;2.5</td>
<td>0</td>
<td>330</td>
<td>7.4</td>
<td>COP = 32-35 mm Hg</td>
</tr>
<tr>
<td>Plasmanate</td>
<td>145 ± 15</td>
<td>&lt;2.0</td>
<td>0</td>
<td>7.4</td>
<td></td>
<td>COP = 20 mm Hg</td>
</tr>
<tr>
<td>10% Dextran 40</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>255</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>HES 450/0.7</td>
<td>154</td>
<td>0</td>
<td>0</td>
<td>310</td>
<td>5.9</td>
<td></td>
</tr>
<tr>
<td>0.9% NaCl</td>
<td>154</td>
<td>0</td>
<td>0</td>
<td>308</td>
<td>6.0</td>
<td></td>
</tr>
<tr>
<td>Lactated Ringer's</td>
<td>130</td>
<td>4</td>
<td>0</td>
<td>273</td>
<td>6.5</td>
<td>Lactate = 28 mEq/L</td>
</tr>
<tr>
<td>5% Dextrose</td>
<td>0</td>
<td>0</td>
<td>50</td>
<td>252</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>D₅LR</td>
<td>130</td>
<td>4</td>
<td>50</td>
<td>525</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>D₅0.45% NaCl</td>
<td>77</td>
<td>0</td>
<td>50</td>
<td>406</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>Normosol-R</td>
<td>140</td>
<td>5</td>
<td>0</td>
<td>294</td>
<td>6.6</td>
<td>Mg = 3, acetate = 27, gluconate = 23 mEq/L</td>
</tr>
</tbody>
</table>
Cell Saver

- Process
  - Suctioned
  - Anticoagulated
  - Centrifuged
  - Washed
  - Reinfused
- CLOSED CIRCUIT

Figure 1. The figure shows how a continuous loop is maintained with the patient in order to perform cell salvage and apheresis for cardiac bypass surgery.

Source
Cell Salvage in the Jehovah’s Witness Patient
Hypotensive Technique

- Alteration of blood pressure
  - Systolic blood pressure of 80–90 mm Hg
  - Mean arterial pressure of 50–65 mm Hg
  - Decrease in mean arterial pressure by 30%

- Reduce intraoperative blood loss

- Ways to achieve hypotension
  - Remifentanil infusion
  - Epidural
  - Beta blocker
  - Vasodilating agent

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**TABLE 45-4  Summary of Parameters and Variables and Their Contribution to a Bloodless Surgical Field**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>↓ MAP ↓ HR ↓ SVR</td>
<td>+++++ + +</td>
</tr>
<tr>
<td>↓ HR Remifentanil</td>
<td>β blockade + +++</td>
</tr>
<tr>
<td>Technique</td>
<td>TIVA Volatile anesthetics + +</td>
</tr>
<tr>
<td>Ventilation</td>
<td>Normocapnia Hypocapnia + +</td>
</tr>
<tr>
<td>Postoperative analgesia</td>
<td>Regional Intravenous/oral + +</td>
</tr>
</tbody>
</table>

HR, Heart rate; MAP, mean arterial pressure; SVR, systemic vascular resistance; TIVA, total intravenous anesthesia; +, minimal effectiveness; ++, equivocal effectiveness; ++++, moderate effectiveness; +++++, maximal effectiveness.
General Intraoperative Interventions

- Positioning
- Ventilation Modes
- Hypothermia
- Minimize phlebotomy
- Tourniquets

Table 1. Methods of blood conservation for “bloodless medicine”

Methods relevant to both medical and surgical patients
- Minimizing laboratory testing
- Low-volume microtainers for phlebotomy
- Tolerating lower hemoglobin levels
- Diagnosing and treating anemia or other cytopenias

Methods relevant only to surgical patients
- Early diagnosis and treatment of preoperative anemia
- Intraoperative autologous blood salvage
- Intraoperative autologous normovolemic hemodilution
- Meticulous surgical technique
- Perioperative antifibrinolytics (tranexamic acid, epsilon aminocaproic acid)
- New methods of electrocautery
- Topical sealants and hemostatic agents
- Avoiding perioperative hypothermia
- Intentional moderate hypotension
52 years, male, NKA

Planned procedure: left arm fistulogram with transposition of left basilic vein

PMH: multiple PEs, HTN, peripheral arterial occlusive disease, DVT of upper extremity, amputation of LLE, GERD, gastroparesis, charcot-marie-tooth, CKD on HD, Fournier’s gangrene, neurogenic bladder, urine retention, necrotizing fasciitis, hyponatremia, DM type 1, hypothyroidism, anxiety, adjustment disorder, depression

Medications: amlodipine, ASA, folic acid, bisacodyl, vitamin D, clonidine, lomotil, Lexapro, lasix, gabapentin, hydralazine, levemir, humulin R, synthroid, percocet, zantac, warfarin, nutritional supplements, heparin for his dialysis catheter
Case Study Continued...
1. What technique includes the removal of blood prior to surgery, administration of colloids or crystalloids, and reinfusion of the removed blood at the end of the case?

2. You plan to use cell saver for your patient who is scheduled for an aortic valve replacement, and they refuse blood product. What type of circuit do you plan to use?

3. You are assessing a Jehovah’s Witness patient in clinic for a fem-pop scheduled in 2 weeks. The patient is anemic. What are some possible preoperative strategies for this case?
Thank You
and
Go Propofolics!!!!